i2dps daemon

`db2dps` is a small daemon running on the database server which convert rules to BGP announcements. The daemon is controlled by `systemd`. The installation is done with `make`.

The current version of `i2dps` is written in Perl. It requires the following Perl modules to be installed:

```
sudo apt-get -y install libnet-openssh-compat-perl liblist-moreutils-per
                        libnet-openssh-compat-perl libnet-ssh2-perl
                        libproc-daemon-perl libnetaddr-ip-perl
                        libdbi-perl libdbd-pg-perl libtypes-path-tiny-pe
```

Installation

On the database host, execute

```
mkdir -p /opt/db2dps && chown sysadm:sysadm /opt/db2dps
```

Edit `Makefile` and copy the source for `db2dps` to `/opt/db2dps`. You only need to change the lines to whatever your heart desire:

```
TARGETHOST      = sysadm@ddps.deic.dk
GID             = sysadm
UID             = sysadm
```

Change `TARGETHOST` and set up `ssh` credentials first. Either (depending on your local environment) do

```
./remote.sh -v make dirs
```

or copy the source to `/opt/db2dps/src` and execute:

```
cd /opt/db2dps/src && make dirs
```

If that goes well then execute

```
./remote.sh -v make all
```

or

```
cd /opt/db2dps/src && make all
```

For the C version, the target will

- fetch, extract and compile required libraries from github
- compile db2dps and place binaries etc. below `/opt/db2dps`
- install db2dps as a systemd service which will start as part of the boot process

For the Perl version the target will

- add version information to `db2dps`
- install db2dps as a systemd service which will start as part of the boot process

Usage and pseudo code below:

Name db2dps

Database / rule manipulation for DDPS

Synopsis

`db2dps [-V] [-v] [-d] [-s seconds]`

Description

`db2dps` process new *rulefiles*, and maintain rules in the database wile sending BGP flowspec updates to a number of BGP hosts. `db2dps` runs as a daemon controlled by systemd.

Options

- **-V**: print version information and exit
- **-v**: verbose and run in foreground
- **-d**: demonise
- **-s** *seconds*: sleep time between database scan. Default is 20 seconds

Pseudo code

```
read configuration || fail
```

```
check args: print version and exit | daemonise | run in foreground

connect to database || exit fail

query(all my networks)

while true; do
{
  if [ exit required ]
  {
    break loop
    close database connection
    exit normal
  }
  else
  {
    sleep except seconds on first loop
  }

   if [ exist (new files with rules from fastnetmon) ]
     if (query(insert rules in database) == OK)
        delete(rulefile) or warn

  foreach bgphost do
  {
    mkrulebase("announce", bgphost)
    {
       if (bgphost requires all rules)
          query(all rules)
       else
          query(NOT isactivated and NOT expired records)
       continue if (query empty)
       {
         if (destination is within all my networks)
         {
           build rules suitable for bgphost
           send rulebase to bgp host || warn
           /* notice: this may block */
         }
         else
         {
           warn about attempt to filter for external network
         }
     }
    }
  }
  query(set isactivated for all announced rules in database)

  foreach bgphost do
  {
    mkrulebase("withdraw", bgphost)
```

```
    {
       query(all isactivated rules)
       select rules which are expired AND does not match a non-expired r
       foreach (bgphosts)
       {
         if (destination is within all my networks)
         {
           build rules suitable for bgphost
           send rulebase to bgp host || warn
           /* notice: this may block */
         }
         else
         {
           warn about attempt to filter for external network
         }
      }
    }
  }
  query(set isexpired for withdrawn rules in database)
}

close database connection and exit normal
```

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Bugs

Probably. Please report them to the the author or the DDPS group. Please notice this is early work.

Rulefiles

Rulefiles has the following format, with a *header* describing the *rule type* where only `fnm` for fastnetmon is in use, rule format if we should ever change it and the *attack type* for later optimisation. The last line is literally *last-line* to avoid processing incomplete files:

```
ruleheader
rule
rule
last-line
```

The format is

```
Rule header: type;vesion;attack_info;
type: fnm | ...
version: 1 | ...
attack_info: icmp_flood | syn_flood | udp_flood | unknown | ...
Rules: networkid,uuid,blocktime,date,time,1,2,3,4,5,6,7,8,9,10,11,12
Type 1 - Destination Prefix
Type 2 - Source Prefix
Type 3 - IP Protocol
Type 4 – Source or Destination Port
Type 5 – Destination Port
Type 6 - Source Port
Type 7 – ICMP Type
Type 8 – ICMP Code
Type 9 - TCP flags
Type 10 - Packet length
Type 11 – DSCP
Type 12 - Fragment Encoding
```

Example:

```
fnm;1;syn_flood;
0;00:25:90:47:2b:48;10;130.226.136.242;66.141.26.81;tcp;14372;80;14372;0
0;00:25:90:47:2b:48;10;130.226.136.242;161.185.77.224;tcp;14374;80;14374
last-line
```

Rule creation

Just my random thoughts, but having to implement something I wonder what is the *best practice for creating rules to mitigate volumetric attacks based on flowspec*?

According to awsstatic.com DDoS attacks are most common at layers 3, 4, 6, and 7 of the Open Systems Interconnection (OSI) model.

Layer 3 and 4 attacks correspond to the Network and Transport layers of the OSI model: these are volumetric infrastructure layer attacks.

Layer 6 and 7 attacks correspond to the Presentation and Application layers of the OSI model, these are as application layer attacks and only the volumetric attacks can be detected by fastnetmon.

#	Layer	Unit	Description	Vector Examples
7	Application	Data	Network process to application	HTTP floods, DNS query floods
			Data representation and	

#	Layer	Unit	Description	Vector Examples
6	Presentation	Data	encryption	SSL abuse
5	Session	Data	Interhost communication	N/A
4	Transport	Segments	End-to-end connections and reliability	SYN floods
3	Network	Packets	Path determination and logical addressing	UDP reflection attacks
2	Data Link	Frames	Physical addressing	N/A
1	Physical	Bits	Media, signal, and binary transmission	N/A

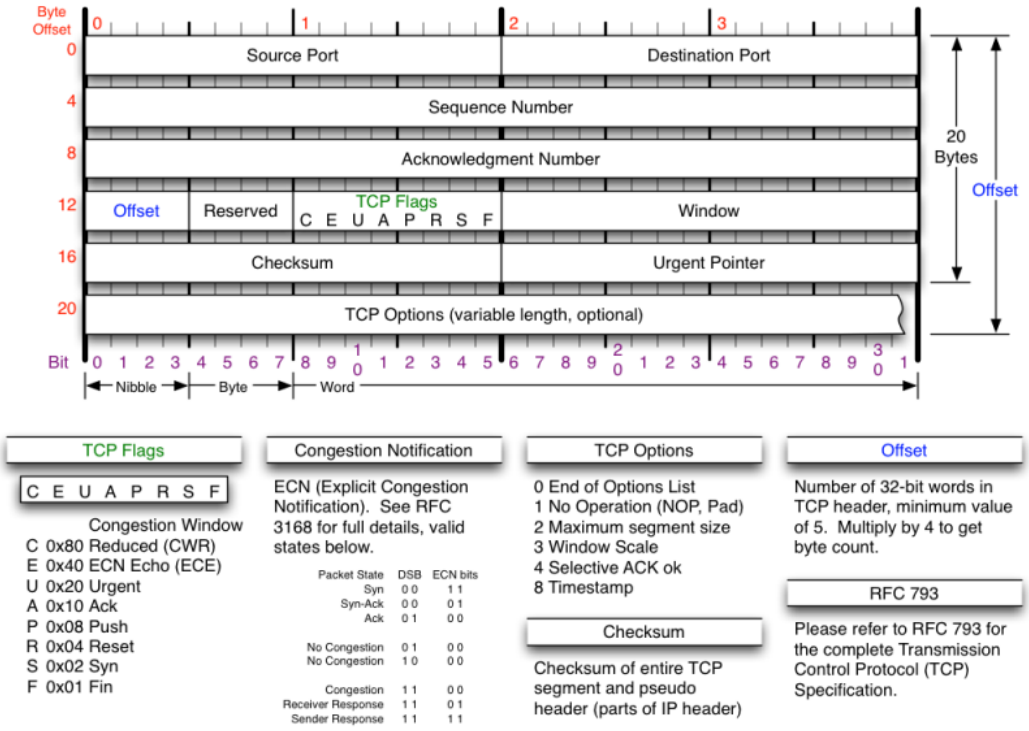
From awsstatic.com

Fastnetmon detects the following type of attacks:

1. *syn_flood*: TCP packets with enabled SYN flag
2. *udp_flood*: flood with UDP packets (so recently in result of amplification)
3. *icmp flood*: flood with ICMP packets
4. *ip_fragmentation_flood*: IP packets with MF flag set or with non zero fragment offset
5. *DNS amplification*:
6. *NTP amplification*:
7. *SSDP amplification*:
8. *SNMP amplification*:

First: it is sometimes possible to distinguish between legitimate and illegitimate packets, as Not All SYNs Are Created Equal . And empty UDP and TCP packet might be rare:

For ethernet is the *minimum payload* 42 octets when an 802.1Q tag is present and 46 octets when absent according to wikipedia on ethernet frames . The minimum Layer 2 Ethernet frame size is 64 bytes for an *empty tcp or udp packet*.



We have the following values for creating a filter:

```
Type 1 - Destination Prefix
Type 2 - Source Prefix
Type 3 - IP Protocol
Type 4 – Source or Destination Port
Type 5 – Destination Port
Type 6 - Source Port
Type 7 – ICMP Type
Type 8 – ICMP Code
Type 9 - TCP flags
Type 10 - Packet length
Type 11 – DSCP
Type 12 - Fragment Encoding
```

Suggestion for rule creation:

Attack type	Mitigation	Match on
syn_flood	rate-limit	tcp option (syn) protocol, destination port, tcp flags, size, (ttl would be nice but is still in draft), and source any
udp_flood	rate-limit	protocol and destination host and port
icmp flood	discard	protocol and destination
ip_fragmentation_flood	rate-limit	protocol and destination

Attack type	Mitigation	Match on
DNS amplification	rate-limit	protocol, port and destination
NTP amplification	rate-limit	protocol, port and destination
SSDP amplification	discard	protocol, port 1900, source any
SNMP amplification	discard	protocol, port, destination

Note: SSDP - *Simple Service Discovery Protocol* (see draft-cai-ssdp-v1–03 does not belong on a WAN an anyway? It's used for UPnP discovery. The same goes for TCP / UDP port 1 - 19.

SNMP does to my best understanding not pass the boundaries of a company network, even not protocol version 3. And sacrificing monitoring data for the sake of the network is fine with me.

Other versions

A version of `i2dps` written in C is also available, but *currently with unresolved memory / heap errors*. It also lacks code for *white listing* and *solving the problem with overlapping rules*.

The C development environment including memory leak test with valgrind may be installed this way:

```
sudo apt-get -y update
sudo apt-get -y upgrade
sudo apt-get -y install build-essential
sudo apt-get -y install valgrind
```

Installation of the C version is documented in the `Makefile`.